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(71) Applicant *(for all designated States except US)*: **VOLVO CONSTRUCTION EQUIPMENT COMPONENTS AB** [SE/SE]; 631 81 Eskilstuna (SE).

(72) Inventors; and
(75) Inventors/Applicants *(for US only)*: **KINGSTON, Timothy** [GB/SE]; Lilla Movägen 10, S-632 39 Eskilstuna (SE). **AKERBLOM, Mats** [SE/SE]; Himmelsända Hässelbyäng, S-635 06 Eskilstuna (SE).

(74) Agent: **FRÖHLING, Werner**; Volvo Technology Corporation, Corporate Patents, 06820, CTP, Sven Hultins Gata 9c, S-412 88 Göteborg (SE).

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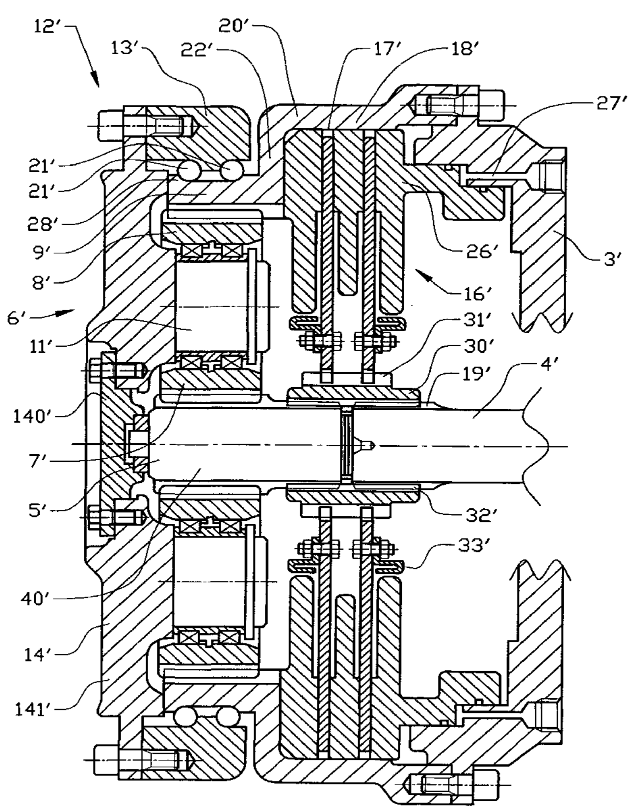
(54) Title: ANNULAR MEMBER FOR A BRAKING DEVICE AND AN ARRANGEMENT FOR DRIVING A WHEEEL OF A VEHICLE WHICH COMPRISES SAID ANNULAR MEMBER



(57) Abstract: The invention relates to an annular member (20') intended for a braking device (16') in the form of a multiple disk brake, which annular member comprises a first portion (18') which forms a part of a brake housing of the braking device and a second portion (22') which forms a pressure surface for the disks in the braking device. The invention also relates to an arrangement for driving a wheel of a vehicle comprising said annular member.

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Annular member for a braking device and an arrangement for driving a wheel of a vehicle which comprises said annular member

FIELD OF THE INVENTION

The present invention relates to an annular member intended for a braking device in the form of a multiple disk brake, which annular member comprises a first portion which forms a part of a brake housing of the braking device. The invention relates moreover to an arrangement for driving a wheel of a vehicle, which arrangement comprises a planetary gear transmission for transmitting power from a driving axle to a wheel hub, on which the wheel is intended to be arranged, a braking device in the form of a multiple disk brake, and said annular member.

The invention can be applied in vehicles which are intended to be driven on a relatively flat surface, such as a road, and/or on uneven ground in the country. The invention is especially applicable to a vehicle in the form of a construction machine, such as a wheel loader or an articulated or frame-steered vehicle (what is known as a dumper), but can also be applied in, for example, a truck.

Such a driving arrangement is usually arranged at a wheel which is in turn arranged at one end of a driving axle, and the gear itself is usually referred to as a hub reduction gear. The driving axle is in turn in two parts, and the parts are connected centrally by a differential gear.

PRIOR ART

US 4,317,498 describes a wheel-driving arrangement comprising a planetary gear transmission. The planetary gear transmission is of a type with a stationary ring gear. The ring gear extends out from the planetary gear transmission in the axial direction and forms a brake

housing for a multiple disk brake. The inner surface of the ring gear in the radial direction has a number of teeth for engagement with the planet gears arranged internally in the planetary gear transmission. These teeth extend into the brake housing part in the axial direction and form a support for the stator disks in the multiple disk brake. In other words, the engagement portions in the planetary gear transmission and in the multiple disk brake are formed by the same tooth track. A pressure plate in the multiple disk brake is arranged in engagement with said teeth and also between the planet gears and the disk pack in the axial direction. The pressure plate is locked in the axial direction by a locking ring. A piston is arranged on a side of the brake disks opposite said pressure plate for pressing the disks together against the pressure plate.

SUMMARY OF THE INVENTION

One object of the invention is to provide an annular member for a braking device, which affords opportunities for more cost-effective production of the braking device and/or a driving arrangement comprising the braking device. Production includes more cost-effective manufacture and/or less time-consuming assembly. The invention also aims to achieve an annular member which affords opportunities for a driving arrangement with a reduced number of component parts in the arrangement and/or a weight reduction.

This object is achieved by virtue of the fact that the annular member comprises a second portion which forms a pressure surface for the disks in the braking device.

According to a preferred embodiment of the invention, the annular member comprises a third portion which is provided with teeth and forms a ring gear which in turn is intended to form part of a planetary gear transmission. In this way, three functions are integrated in one and the same element.

According to a development of the previous embodiment, the first portion is arranged at a greater distance in the radial direction of the annular member than the third portion. This affords opportunities for a constructionally simple part. The second portion preferably forms a part located between the first and third portions of the annular member.

According to another preferred embodiment of the invention, the annular member comprises a fourth portion which forms a bearing unit for mounting a hub. In this way, four functions can be integrated in one and the same element. The fourth portion preferably comprises at least one race for receiving at least one row of balls. The fourth portion preferably forms an outer part of the ring gear in the radial direction.

A further object of the invention is to provide a driving arrangement which is more cost-effective to produce in relation to previously known art. Production includes more cost-effective manufacture and/or less time-consuming assembly. The invention also aims to achieve a driving arrangement which affords opportunities for a reduction of the number of component parts in the arrangement and/or a weight reduction.

This object is achieved by means of a driving arrangement with the features according to claim 15, that is to say by virtue of the fact that the arrangement comprises a planetary gear transmission for transmitting power from a driving axle to a wheel hub, on which the wheel is intended to be arranged, a braking device in the form of a multiple disk brake, and the abovementioned annular member.

According to another embodiment of the invention, the braking device and the hub are arranged on the planet

carrier on different sides of said planet gear. In this way, opportunities are afforded for producing a device which is compact, that is to say requires less space, in the axial direction.

According to another preferred embodiment of the invention, the hub is mounted against the annular member and, to be precise, against the annular member outside in the radial direction that portion of the annular member which forms the ring gear and also against said portion. In this way, opportunities are afforded for a device which is compact, that is to say requires less space, in the axial direction.

According to another preferred embodiment of the invention, the bearing arrangement between the hub and the gearwheel comprises at least one row of balls arranged along a circular track and also between races designed in the hub and the ring gear. By virtue of such an arrangement, opportunities are afforded for a device which is cost-effective from the point of view of production and compact in the axial direction.

Further preferred embodiments and advantages of these emerge from the description below and from the claims.

BRIEF DESCRIPTION OF THE FIGURES

The invention will be described in greater detail below with reference to the embodiments shown in the accompanying drawings, in which

FIG. 1 shows a diagrammatic, partly cut-away side view of the invention according to a first embodiment, and

FIG. 2 shows a diagrammatic, partly cut-away side view of the invention according to a second embodiment.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Fig. 1 shows a first embodiment of a driving arrangement 1 in a diagrammatic side view. The driving arrangement 1 is arranged at one end of the axle case 3 of a wheel axle 2. A driving axle 4 extends inside the axle case 3. The driving axle 4 is, at one 5 of its ends, provided with a hub reduction gear 6 in the form of a planetary gear transmission. At its other end, the driving axle 3 is operationally connected to a central gear (not shown) which, via a drive shaft, is driven by the engine of the vehicle.

According to conventional art, the planetary gear transmission 6 comprises a sun gear 7, a number of planet gears 8 and a ring gear 9, which are arranged in driving interconnection via teeth. The planetary gear transmission 6 is of a type with a stationary ring gear, and the ring gear 9 is here connected firmly to the axle case 3 via screw joints 10.

A planet carrier 11, also known as a planet gear holder, is adapted so as to hold the planet gears 8. To be precise, the planet gears 8 are mounted on the planet carrier 11. The number of planet gears 8 in the preferred embodiment is three, but, within the scope of the invention, the number of planet gears can be one, two, four or more.

The driving arrangement comprises an annular member 20 which in turn comprises a first portion 18 which forms a part of a housing for a braking device 16, and a second portion 22 which forms a pressure surface for the disks in the braking device 16. The annular member 20 also comprises a third portion 9 which forms said ring gear in the planetary gear transmission.

The braking device 16 consists of a wet brake in the form of a multiple-disk brake. The braking device 16 comprises two sets of brake disks which rotate in relation to one another during operation. A first set

of brake disks (stator disks) is connected to the first portion 18 of the annular member 20, which portion is arranged outside the planet carrier 11 in the radial direction.

The first portion 18 of the annular member 20 is arranged outside the stator disks in the radial direction. The first portion 18 also comprises internally arranged guide surfaces 17 for engagement with and guidance in the axial direction of the stator disks when the braking device 16 is activated. The guide surfaces 17 consist of a number of parallel ridges, or teeth, which extend in the axial direction. In this case, the connection between the annular member 20 and the stator disks consists, to be precise, of a spline joint 17.

A second set of brake disks (rotor disks) is connected to the planet carrier 11. The planet carrier 11 has guide surfaces, similar to those described above for the annular member 20, in the form of a number of parallel ridges, or teeth, for engagement with and guidance in the axial direction of the rotor disks when the braking device 16 is activated. Here, the connection also consists of a spline joint 19.

The brake disks are connected to the respective part in a rotationally fixed manner and are displaceable in the axial direction on said spline joints 17, 19. In a conventional manner, the brake disks belong alternately to the first set and to the second set. The planet carrier 11, which is connected firmly to the hub 12 and thus has the same speed as the wheel during operation, is in this way braked against the static part 18.

The braking device 16 also comprises a brake piston 26 for applying the brake by pressing the brake disks together and thus increasing the friction between them. A duct 27 for supplying oil for applying the brake is

coupled to the brake piston. On an opposite side of the brake disks relative to the brake piston 26, the second portion 22 of the annular member 20 forms a pressure surface, or stay, against which the disks are brought when the brake is applied. The first portion 18 is annular, and the pressure surface extends, to be precise, in a plane essentially at right angles to a central axis of the annular first portion 18.

By means of this type of braking device 16, the wheel is braked directly. By virtue of the fact that the wheel is braked directly, that is to say the braking takes place after the planetary gear transmission 6, a part is braked which has a lower rotation speed relative to the driving axle (the driving axle usually has a speed which is approximately six times higher than that of the wheel). In this way, it is possible to obtain very good adjustability of the braking, which is especially advantageous for application in vehicles which require great braking power within a large speed range. Such a vehicle consists of, for example, a dumper.

As emerges from the description above, the first and the second portions 18, 22 are therefore integrated in one piece.

The second portion 22 of the annular member 20 projects inward in the radial direction from the first portion 18. The second portion 22 is furthermore continuous in the peripheral direction of the annular member.

The first portion 18 of the annular member 20 is arranged in a first position in the radial direction. The third portion 9, in the form of the ring gear, of the annular member 20 is arranged in a second position at a smaller distance in the radial direction than the first portion. The second portion 22 of the annular member 20, which forms the pressure surface for the

brake disks, is arranged between the first and third portions. This intermediate portion 22 extends in the radial direction and connects the ring gear 9 and the brake housing part 18. The first and third portions 18, 9 also project in different directions in the axial direction from the second portion 22. The first, second and third portions of the annular member are therefore integrated in one piece.

The annular member 20 also comprises a fourth portion 28 for mounting a hub 12. The hub 12 is intended to carry a wheel (not shown) and is mounted outside the ring gear 9 in the radial direction and also against it. The fourth portion 28 is therefore integrated in the third portion here. The wheel hub 12 is also connected firmly to the planet carrier 11. In the embodiment shown, the hub comprises an annular part 13 and a disk-shaped cover 14 connected firmly to the annular part 13. The annular part 13 is arranged outside the ring gear 20 in the radial direction and is also mounted against it. This is described in greater detail below. The annular part 13 and the disk-shaped cover 14 are interconnected firmly via screw joints 15. The cover 14 is arranged outside the planetary gear transmission 6 in the axial direction and protects the latter from the external environment. The hub 12, and to be precise the cover 14, is connected firmly to the planet carrier 11. The wheel is fastened by a conventional fastening device (not shown) on the hub 12, usually a bolt joint.

The annular member 20 therefore has a number of functions such as: it functions as a holder for the planetary gear transmission 6, that is to say it is connected firmly to the axle case 3, it functions as a brake housing and pressure surface for the braking device 16, and it functions as a bearing unit 21 for mounting the wheel hub 13.

The bearing arrangement 21 between the hub 13 and the ring gear 9 comprises a row of a number of balls arranged along a circular track between races designed in the hub 13 and the ring gear 9. Such a bearing arrangement is often referred to as a four-point bearing owing to the fact that four surfaces are ground for contact with the balls. In order to form the bearing arrangement, a number of balls are therefore mounted in between the ring gear 9 and the hub 13. In other words, there is no conventional ball bearing between the parts. Race means that a surface area is designed for receiving the balls. This surface area usually has a curved or angled shape.

The word "annular" used above is to be understood in a wide sense, and the term annular includes various forms of at least essentially circular structures which are continuous in the peripheral direction. The first annular portion 18 has the shape of a ring and consists of a continuous structure in the peripheral direction with an extent in the axial direction. The inner surface of the first portion 18 in the radial direction also defines an essentially circular shape for receiving the stator disks.

The braking device 16 and the hub 12 are arranged on different sides of said planet gears 8. To be precise, the braking device 16 is arranged on the planet carrier 11 for direct braking thereof relative to the annular member 20. The hub 12 is in turn connected firmly to the planet carrier 11. The planet gears 8 are mounted on pivots 24 which project from the disk-shaped cover 14. That part 25 of the planet carrier 11 which forms the brake housing is connected to the pivots 24 via screw joints 23. According to an alternative embodiment, the planet carrier part 24 and the brake housing part 25 are formed in one piece.

Figure 2 illustrates a second embodiment of the invention. This embodiment differs from the first embodiment in that the rotor disks in the braking device 16' are connected in a rotationally fixed manner to the driving axle 4' instead of to the planet carrier 11'. This is brought about by virtue of a sleeve 30' being arranged around the driving axle 4'. The sleeve 30' has internal guide surfaces in the form of splines 32' for engagement with guide surfaces in the form of splines 19' of the axle 4' and external guide surfaces in the form of splines 31' for rotationally fixed engagement with the brake disks intended for rotation.

The driving axle 4' is also divided, the axle portion 40' which forms the axle end 5' constituting a part of the sun gear 7'. The cover 14' consists of two parts here, a first, central part 140' being arranged outside the sun gear 7' in the axial direction. The first cover part 140' is detachably connected, via a screw joint, to a radially outer, second cover part 141' and has a sufficiently great extent in order, when removed, to form a sufficiently large hole for access to the sun gear 7'. In this way, access to the internal components from outside is facilitated without it being necessary to remove the tire of the vehicle, which is especially advantageous in servicing vehicles with heavy tires.

The sleeve 30' also extends over a part of the axle portion 40', and its internal guide surfaces 32' are also arranged in rotationally fixed engagement with corresponding external guide surfaces of the axle portion 40'. In this way, the power is transmitted from the driving axle 4' to the sun gear 7' during operation.

A number of members 33' are furthermore firmly connected to the rotation disks for the purpose of providing the friction surfaces between the disks with

oil. Such a member 33 is usually referred to as an impeller.

The annular member 20' comprises parts corresponding to those described above for the embodiment in Figure 1, but with slightly modified dimensions and shapes.

Figure 1 also shows the bearing arrangement 21 in the form of a row of balls which are received in races in the hub and the ring gear. Figure 2 shows the bearing arrangement 21' in the form of two rows of balls, which rows are arranged with a mutual spacing in the axial direction. This type of bearing arrangement is usually referred to as an angular contact bearing. According to another conceivable alternative, other types of bearing arrangements can be used, such as roller bearings and then in particular conical roller bearings.

The multiple disk brake described above is sometimes referred to as a friction brake, and one set of brake disks is then referred to as friction disks while the other set of brake disks is referred to as reaction disks.

The invention is not to be regarded as being limited to the illustrative embodiments described above, but a number of further variants and modifications are conceivable within the scope of the patent claims which follow. For example, the application may differ, or the engine of the vehicle may be arranged so as to drive the driving axle 4 directly, that is to say without an intermediate drive shaft and central gear.

PATENT CLAIMS

1. An annular member (20, 20') intended for a braking device (16, 16') in the form of a multiple disk brake, which annular member comprises a first portion (18, 18') which forms a part of a brake housing of the braking device, characterized in that the annular member (20, 20') comprises a second portion (22, 22') which forms a pressure surface for the disks in the braking device.

2. The annular member as claimed in claim 1, characterized in that the first portion (18, 18') has the shape of a ring.

3. The annular member as claimed in claim 2, characterized in that said pressure surface extends in a plane essentially at right angles to a central axis of the annular second portion (18, 18').

4. The annular member as claimed in claim 2 or 3, characterized in that the second portion (22, 22') projects inward in the radial direction from the first portion (18, 18').

5. The annular member as claimed in any one of the preceding claims, characterized in that the first portion (18, 18') comprises guide surfaces for guidance in the axial direction of at least one first brake disk when the braking device (16, 16') is activated.

6. The annular member as claimed in claim 5, characterized in that said guide surfaces consist of a number of parallel ridges which extend at least partially in the axial direction.

7. The annular member as claimed in any one of the preceding claims, characterized in that the annular member (20, 20') comprises a third portion (9, 9') which is provided with teeth and forms a ring gear

which in turn is intended to form part of a planetary gear transmission (6, 6').

8. The annular member as claimed in claim 7, characterized in that the first portion (18, 18') and the third portion (9, 9') are arranged at different distances in the radial direction of the annular member (20, 20').

9. The annular member as claimed in claim 7, characterized in that the first portion (18, 18') is arranged at a greater distance in the radial direction of the annular member (20, 20') than the third portion (9, 9').

10. The annular member as claimed in claim 8 or 9, characterized in that the second portion (22, 22') forms a part located between the first and third portions (18, 18' and 9, 9') of the annular member (20, 20').

11. The annular member as claimed in any one of claims 7-10, characterized in that the second portion (22, 22') is arranged in such a way that said pressure surface is formed at one end of the ring gear in the axial direction of the annular member (20, 20').

12. The annular member as claimed in any one of the preceding claims, characterized in that the annular member (20, 20') comprises a fourth portion (28, 28') which forms a bearing unit (21, 21') for mounting a hub (12, 12').

13. The annular member as claimed in claim 12, characterized in that the fourth portion (28, 28') comprises at least one race for receiving at least one row of balls.

14. The annular member as claimed in any one of claims 7-11 and claim 12 or 13, characterized in that the fourth portion (28, 28') forms an outer part of the ring gear in the radial direction.

15. An arrangement for driving a wheel of a vehicle, which arrangement comprises a planetary gear transmission (6, 6') for transmitting power from a driving axle (4, 4') to a wheel hub (12, 12'), on which the wheel is intended to be arranged, a braking device (16, 16') in the form of a multiple disk brake, and an annular member as claimed in any one of claims 1-14.

16. The arrangement as claimed in claim 15, characterized in that the planetary gear transmission (6, 6') comprises a sun gear (7, 7') connected to the driving axle (4, 4'), a planet carrier (11, 11'), on which at least one planet gear (8, 8') is arranged, which planet gear is also arranged in engagement with the sun gear (7, 7'), and a ring gear (9, 9') arranged around and also in engagement with said planet gear.

17. The arrangement as claimed in claim 16, characterized in that the braking device (16, 16') and the hub (12, 12') are arranged on the planet carrier (11, 11') on different sides of said planet gear (8, 8').

18. The arrangement as claimed in any one of claims 15-17, characterized in that the hub (12, 12') is mounted against the annular member (20, 20').

19. The arrangement as claimed in claim 18, characterized in that the bearing arrangement (21, 21') between the hub (12, 12') and the annular member (20, 20') comprises at least one row of balls arranged along a circular track and also between races designed in the hub and the annular member (20, 20').

20. The arrangement as claimed in claim 19, characterized in that the bearing arrangement (21') between the hub (12') and the ring gear (9') comprises two rows of balls, which rows are arranged at a mutual spacing in the axial direction of the driving axle (4').

21. The arrangement as claimed in any one of claims 15-20, characterized in that the hub (12, 12') is connected firmly to the planet carrier (11, 11').

22. The arrangement as claimed in any one of claims 15-21, characterized in that the braking device (16) is adapted to brake the planet carrier (11) relative to the first portion (18) of the annular member (20).

23. The arrangement as claimed in any one of claims 15-21, characterized in that the braking device (16') is adapted to brake the driving axle (4') relative to the first portion (18') of the annular member (20').

24. The arrangement as claimed in any one of claims 15-23, characterized in that the annular member (20, 20') is connected firmly to an axle case (3, 3').

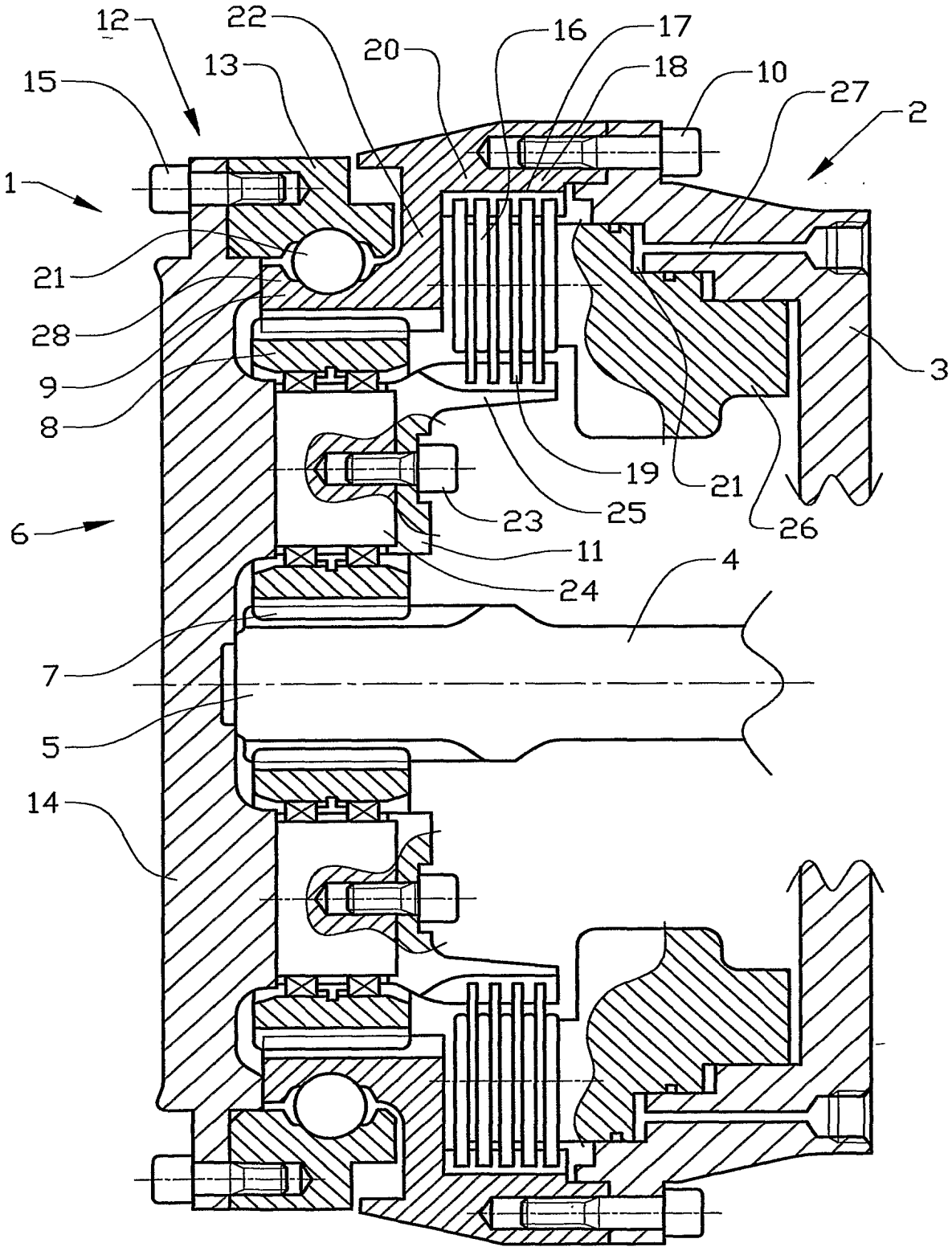

Fig.1

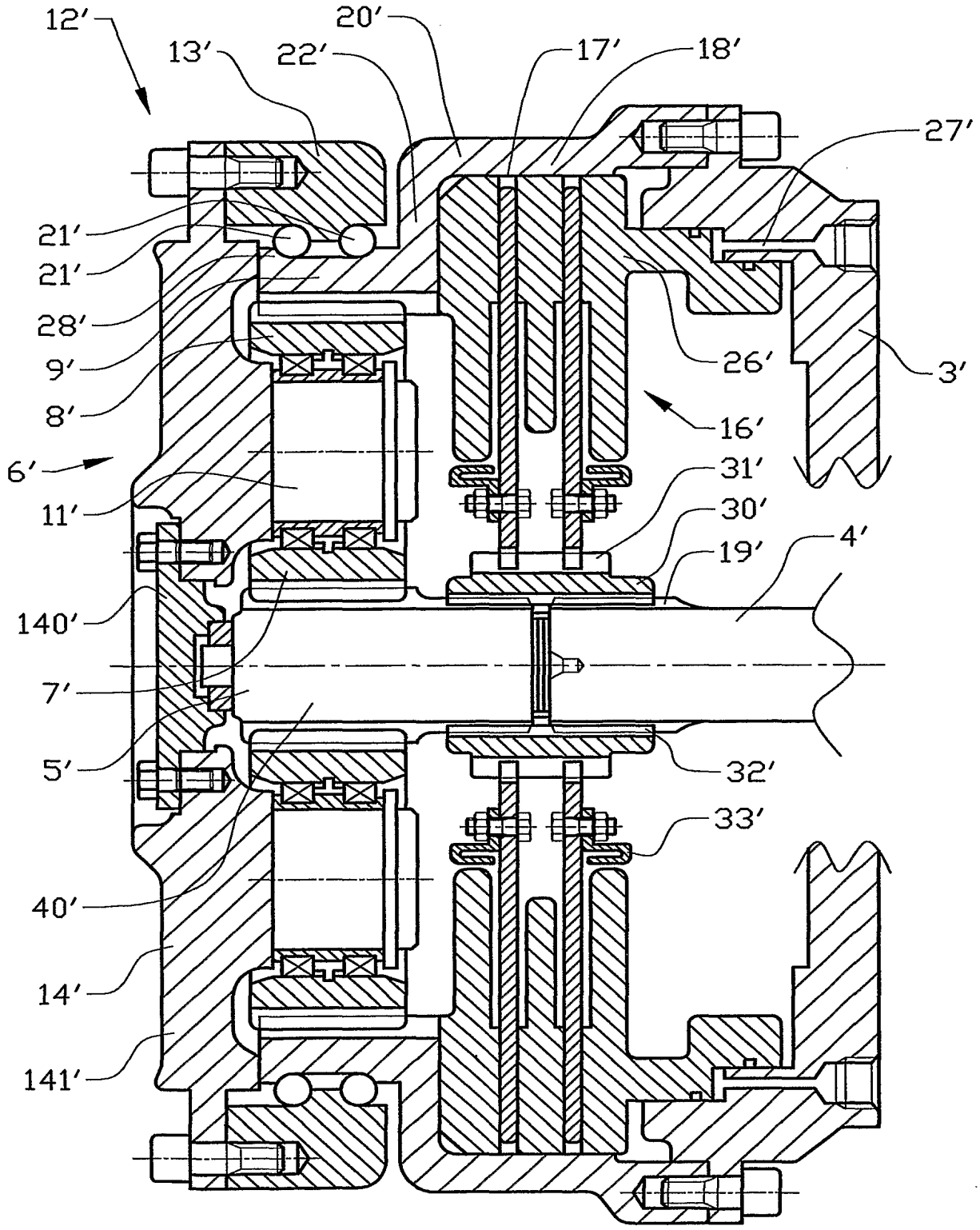
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Fig.2

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 02/02007

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: F16D 55/36
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: B60K, B60T, B16D, F16H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL, WPI DATA, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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A	US 4947966 A (HUFF), 14 August 1990 (14.08.90)	1-24
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[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
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"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
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Date of the actual completion of the international search	Date of mailing of the international search report
5 February 2003	07 -02- 2003
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Alexandra Jarlmark/EK Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 02/02007

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4583428 A (GARNIER), 22 April 1986 (22.04.86) -- --------	1-24

INTERNATIONAL SEARCH REPORT

Information on patent family members

30/12/02

International application No.
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